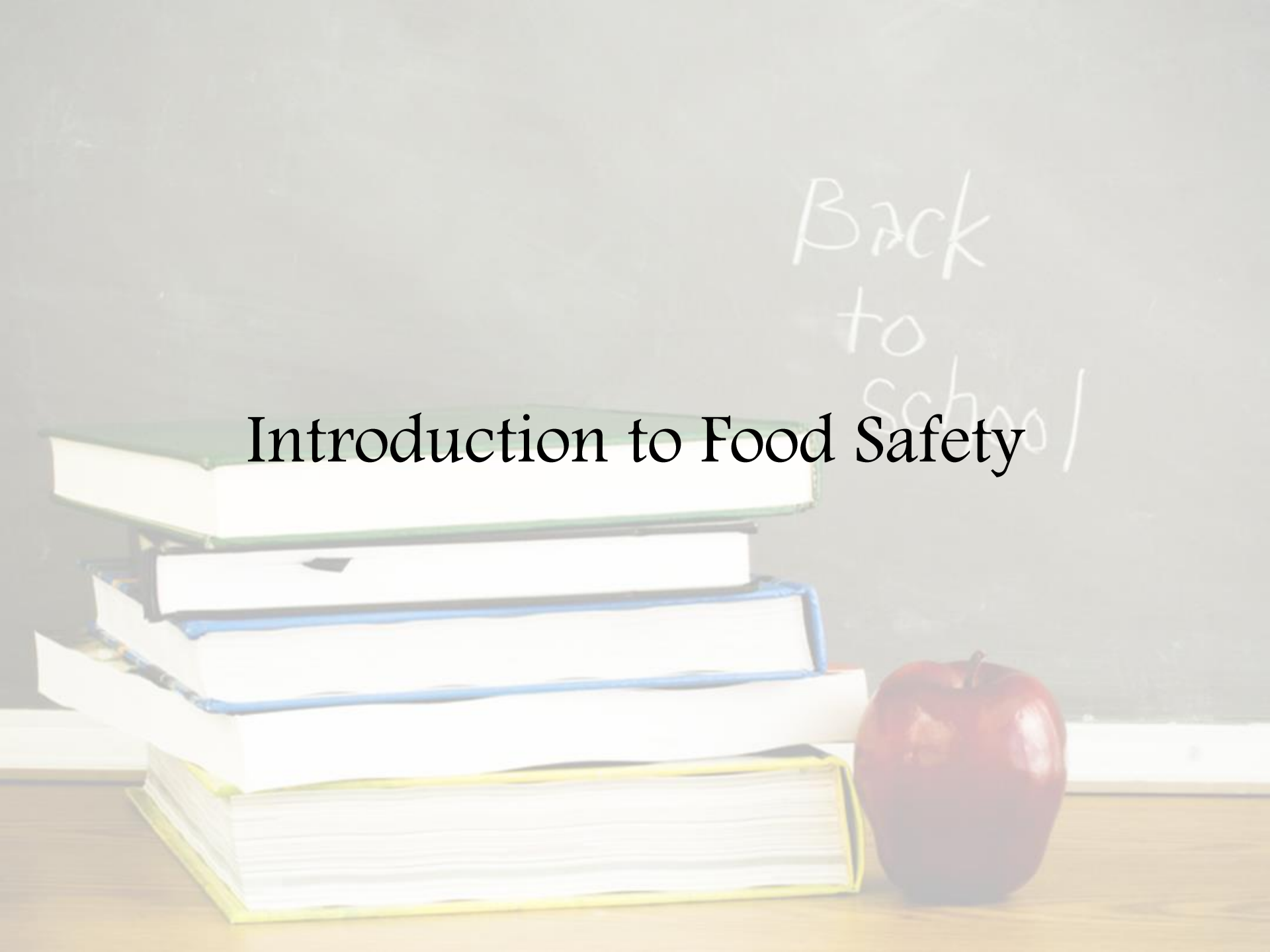


Introduction to Food Safety

Objectives

- Food safety and personal hygiene
  - The types of food contamination
  - Food safety
  - Employee's personal hygiene

Important contribution factors in Iran

- **Contamination**
  - Cross contamination of ready-to-eat food by raw food
  - Contaminated raw food
  - Poor personal hygiene
  - Inadequate cleaning of equipment
  - Contamination by food handlers, e.g. hands, cloths and equipments

- **Temperature**
  - Inadequate cooking/ reheating
  - Inappropriate storage temperature
  - Inadequate cooling and cold holding

- **Time**
  - Prolonged storage

Consequences or costs of poor food safety

Merits of Good Food Hygiene and Price for Bad Food Hygiene		
	Merits of Good Food Hygiene	**Price for Bad Food Hygiene**
Regulations	• Comply with statutory requirements • Comply with licensing requirements and conditions • Reduce the chance of food poisoning incidents	• Breach the law and be prosecuted • Be fined or pay lawsuit fees • Victims may bring civil action
Business	• Earn reputation and boost business • Improve productivity	• Lose goodwill • Reduce productivity • May cause closure of business
Employees	• Elevate morale • Reduce staff turnover • Good working environment	• Lose work days • Increase staff turnover • Unemployment
Food	• Extend shelf life of food • Ensure the quality of food	• Food wastage

Food Safety Terminology

- Food Safety: assurance that food will not cause harm to the consumer when it is prepared and /or eaten according to its intended use (free from harmful substances)

- Food Hygiene: all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain

- Food Suitability: assurance that food is acceptable for human consumption according to its intended use

Food Safety Terminology (Food poisoning)

- "An acute illness usually of sudden onset, due to the consumption of contaminated or poisonous food"

- Common causative agents:
  - Bacteria:
    - Pathogenic type – *Vibrio spp , Salmonella spp*
    - Toxin type –*Staphylococcus aureus, Clostridium botulinum*
  - Chemicals:
    - Pesticides
    - Natural toxins (Biochemicals)
      - Plant type – mushroom, sprout potato
      - Animal type – puffer fish
  - Viruses e.g. *Hepatitis A*

Food Safety Terminology (Food Borne Disease)

- *Differs from food poisoning in that:*
  - *A relatively small number of organisms is capable of causing the illness*
  - *The food acts purely as a vehicle and the multiplication of the organism within the food is not an important feature of the illness*

Food Borne Disease

- We divide the illnesses and the bacteria that cause them into two categories:
  - Caused directly by the invasion of the body by bacteria ***(Food infection)***
  - Caused by bacterial toxins produced either directly on the food or produced in the body after ingestion ***(Food intoxication)***

Food Hazard and Contamination

- A *food hazard* is anything that can contaminate the food or cause harm to the consumer.

- **Food contamination:** refers to any harmful substances unintentionally added to food. These substances may come from natural sources or environmental pollution, or arise from food processing.

Food hazards occur from one of three sources:

Chemically
Biologically
Physically

Food hazards

- **Chemical contamination** are chemicals or compounds that can potentially harm the heath of humans. In the short term it may cause severe vomiting, but in the long term may lead to serious illnesses –such as, cancer – and damage to organs such as the liver, kidney, brain, etc.

- **Biological contamination** is living organism or agent derived by viruses, bacteria, fungi, ….. that can cause many health effects.

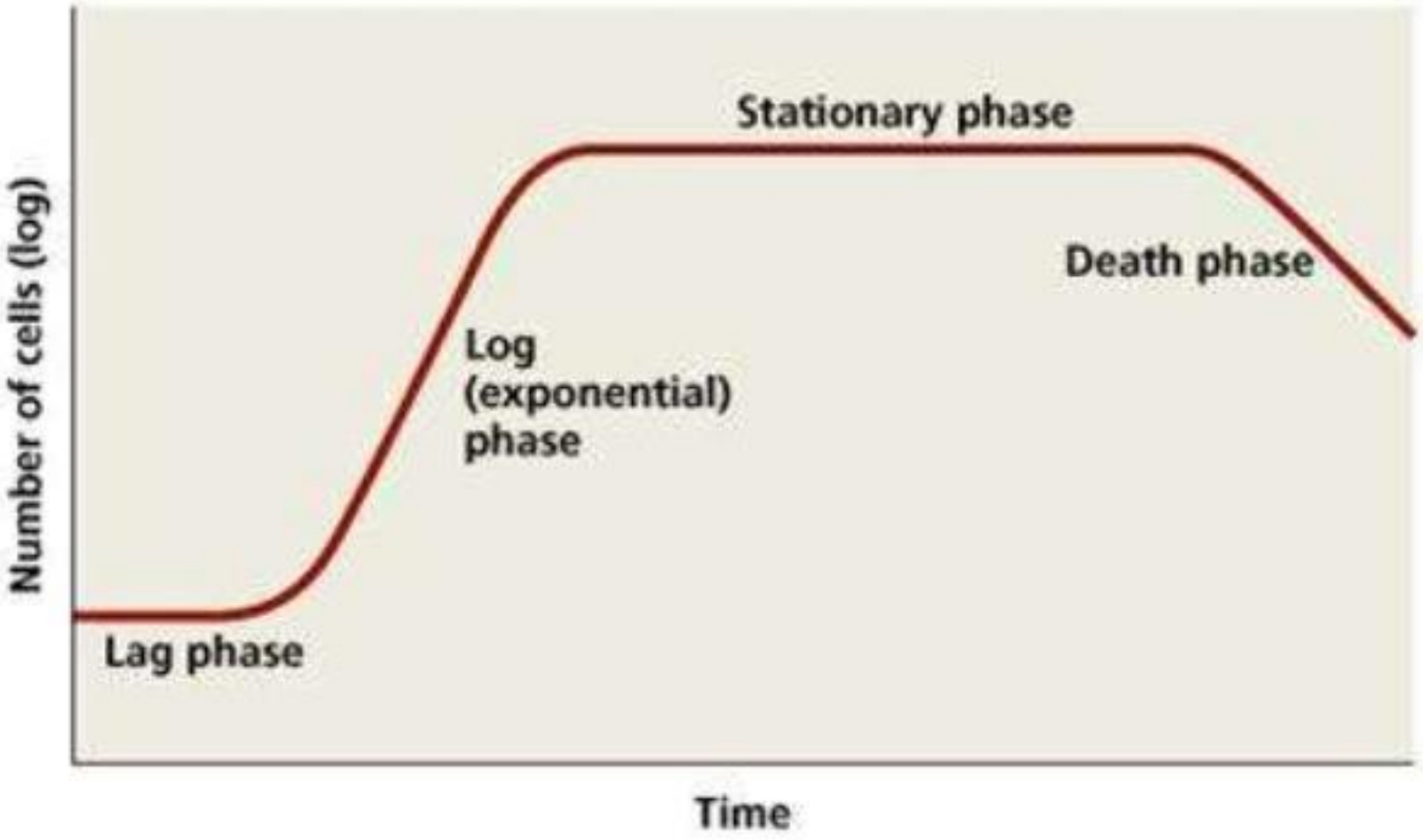
- **Physical contamination** is both objectionable (because it can be seen by consumer, unlike chemical or biological contamination) and harmful to health – causing:
  - Broken teeth

Biological Contamination

- **High-risk group**:
  - young children
  - elderly people
  - chronic patients
  - pregnant women



Bacteria Growth Phase



Six Conditions Bacteria Needs to Grow

Food

Acidity

Time

Temperature

Oxygen

Moisture

F Food	There are sufficient nutrients available that promote the growth of microorganisms. Protein-rich foods, such as meat, milk, eggs and fish are most susceptible.
A Acidity	Foodborne pathogens require a slightly acidic pH level of 4.6-7.5, while they thrive in conditions with a pH of 6.6-7.5. FDA regulations for acid/acidified foods require that the food be brought to pH 4.5 or below.
T Time	Food should be removed from "the danger zone" (see below) within two hours, either by cooling or heating. While most guidelines state two hours, a few indicate four hours is still safe.
T Temperature	Foodborne pathogens grow best in temperatures between 41 °F (5 °C) to 135 °F (57 °C), a range referred to as the temperature danger zone (TDZ). They thrive in temperatures that are between 70 °F (21 °C) to 120 °F (49 °C).
O Oxygen	Almost all foodborne pathogens are aerobic, that is requiring oxygen to grow. Some pathogens, such as clostridium botulinum, the source of botulism, are anaerobic and do not require oxygen to grow.
M Moisture	Water is essential for the growth foodborne pathogens, water activity (a_w) is a measure of the water available for use and is measured on a scale of 0 to 1.0. Foodborne pathogens grow best in foods that have a a_w between 1.0 and 0.86. FDA regulations for canned foods require a_w of 0.85 or below.

Potentially Hazardous Foods (PHF)

1. Types of foods that have the ability to support the rapid and progressive growth of infectious and toxin-producing microorganisms.
2. Examples are red meats, poultry, eggs, fish, dairy products and cooked potatoes.
3. FDA Food Code of PHF
    1. Foods of animal origin that are raw or heat-treated.
    2. Foods of plant origin that are heat-treated or consist of raw seed sprouts.
    3. Cut melons
    4. Garlic and oil mixtures that are not modified in a way to inhibit the growth of microorganisms.
4. It is critical that you control the handling and storage of PHF to prevent bacterial growth.

Microbiological contamination

- Microbiological contamination can result in foodborne illnesses.
- Symptoms include nausea, vomiting, stomach pain, diarrhoea and fever.

Microbiological contamination

Bacteria

- Grows rapidly under moist and warm conditions.
- Killed when exposed to temperatures over 60 degrees Celsius.

Moulds

- Are fungi that grow on spores
- Grow well under dark, wet and warm conditions.
- Usually on bread, cheese and fruits.

Yeasts

- Are fungi that grow by budding.
- Grow well under moist and warm conditions.
- Usually on sweet foods like grapes.

Examples of bacterial food poisoning:

Bacteria	Source/ Contaminated Food	Characteristics of Bacteria
Bacillus Cereus	Rice and rice based items, meat, fish, milk, vegetables, pasta, soya beans	Spore former Production of two toxins
Clostridium Botulinum	Soil and water Canned food	Poor competitor Formation of neurotoxin – double vision, difficulty in speaking and swallowing
Clostridium Perfringens	human and animal intestine, soil, dust	Spore former, anaerobic,
Listeria Monocytogenes	chilled or delicatessen products – soft cheeses, cold cut, pate	Psychotropic – able to grow at 1°C – 3°C
E. coli 0157 H7	raw meat, undercooked meat products and raw milk	Extremely resilient organism High mortality rate Gut origin
Salmonella	Raw meat and products, undercooked eggs and egg products	Cannot form spores Dies at 70°C
Staphylococcus Aureus	Human skin, hair, nasal cavity, wounds	Cannot form spores, but its toxins are heat resistible
Vibrio Parahaemolyticus	Seafood, shellfish	Dies after heating at a high temperature for 10 minutes

Common symptoms of bacterial food poisoning

Bacillus Cereus	• Vomiting and abdominal cramps
Clostridium Botulinum	• Constipation, diarrhoea and vomiting, double vision, difficulty in speaking and swallowing
Clostridium Perfringens	• Diarrhoea and abdominal pain. Vomiting rare
Listeria Monocytogenes	• Septicaemia, meningitis
Escherichia coli 0157 H7	• Abdominal pain, fever, bloody diarrhea, kidney failure
Salmonella	• Fever, abdominal pain, diarrhoea and vomiting
Staphylococcus Aureus	• Nausea, abdominal pain, diarrhoea and vomiting
Vibrio Parahaemolyticus	• Nausea, fever, abdominal pain, diarrhoea and vomiting

Viruses

- Much smaller than bacteria and highly infectious – one third smaller than bacteria

- No complete cell structure and cannot reproduce independently – can only multiply within a cell

- Examples include:
  - Hepatitis A
  - Norwalk (Norovirus)
  - Rotavirus

Viruses

- Remember –do *not require the food/water for multiplication*
- Viruses are typically water borne
- Contamination at source (food eaten raw) and by handling
- Normal cooking temperatures denatures viruses
- Raw foods most implicated in outbreaks
- Infective dose very small – can be a single virus
- Very contagious and person to person spread is common outbreaks
- Spread by faecal – oral route

Viruses (*Hepatitis A)*

- If infected you gain life long immunity
- Symptoms: fever, nausea, vomiting, abdominal pain, liver disease
- illness lasts several days to several months
- Gastro-intestinal tract usual source but blood and urine also implicated
- Implicated foods: sewage contaminated water, raw shell fish, vegetables, salads
- Control: standard food hygiene practices, water quality, approved shell fish beds

Viruses (*Norwalk Viruses)*

- Small round structured viruses
- Source: human intestine and sewage contaminated water
- Implicated foods: shellfish, vegetables, salads and water
- Symptoms: nausea, vomiting, diarrhoea and abdominal pain
- Control: standard food hygiene practices, water quality, approved shell fish beds

Viruses (*Rotavirus)*

- 500,000 cases and 1 million deaths worldwide each year
- Effects young children causing severe diarrhoea and dehydration
- Source: humans, sewage contaminated water
- Control: standard food hygiene practices

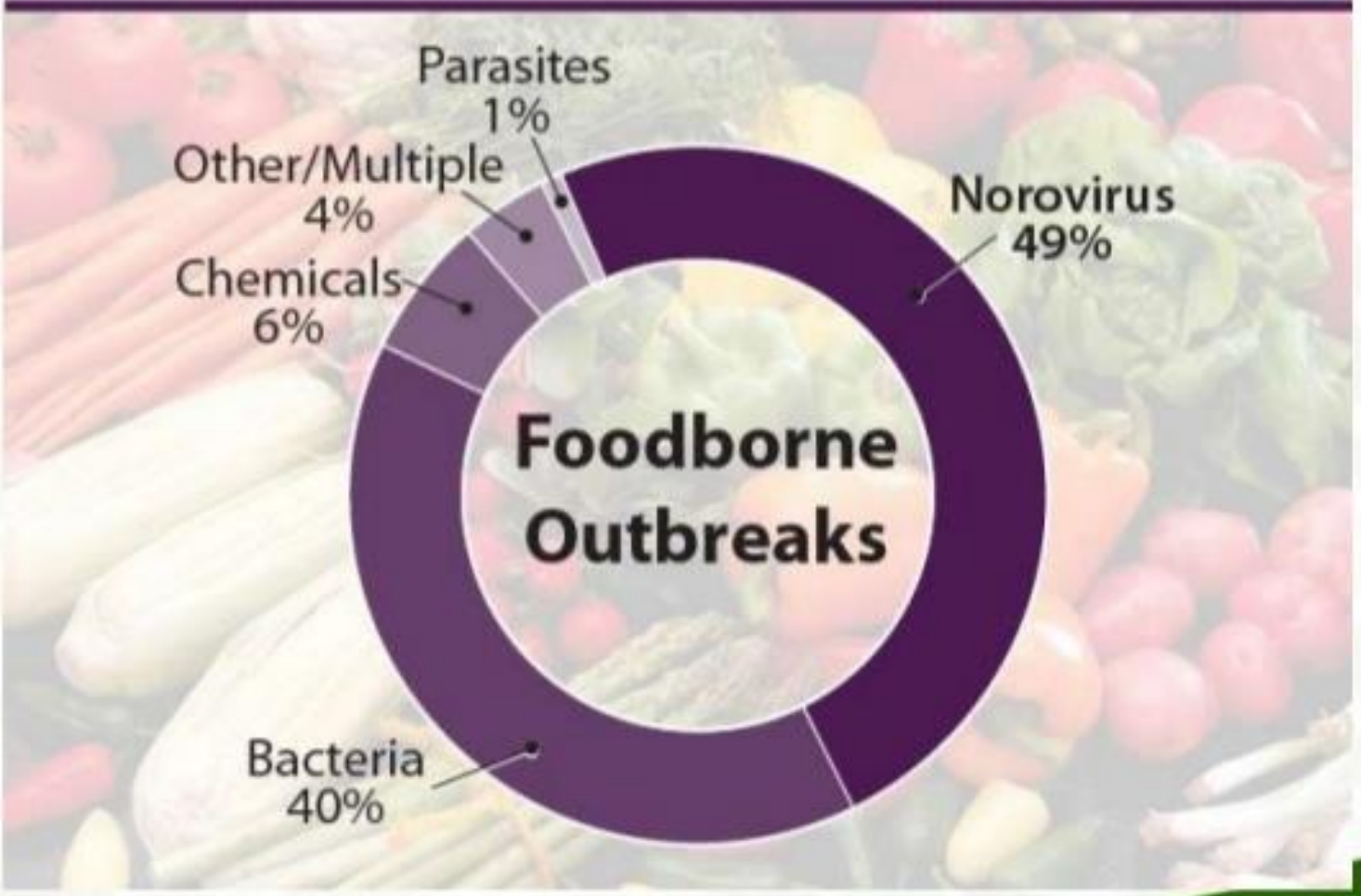
Parasites

- Parasites are organisms that can live on or in a host as well as to derive benefit from or at the expense of its host.

- They can be found on various kinds of food, such as meats, seafood and fresh produce.

- Two main types of parasites found in food are protozoa and helminths (also known as worms).

Known Causes of Foodborne Illness Outbreaks, U.S., 2006–2010



foodsafetyzone

Break the Food Poisoning Chain!

Deny food poisoning bacteria …

Warmth Moisture Food Time

… and you will stop food poisoning!

foodsafetyzone

Break the food poisoning chain

- Warmth: Most bacteria grow rapidly at body temperature (37 degrees C), but can grow between 5 and 63 degrees = danger zone. Some bacteria multiply between 0 and 20 degrees.
- Moisture: All bacteria need moisture, and many dried or dehydrated foods such as milk powder, powdered eggs etc. will allow bacterial growth if they become moist. It's therefore very important to keep dried foods dry. And also important that all cooking equipment is allowed to dry properly after use.

Food poisoning

Bacteria	Source	Symptoms & onset time	Precautions
Staphylococci	Humans: nose, mouth, skin. Untreated milk.	Intense vomiting and watery diarrhea start 1-4 h after ingestion and last as long as 24-48 h	Keep skin clean. Don't sneeze or cough on food. Wash hands, cover cuts.
B cereus *Forms spores and releases toxins which cause illness*	Contaminated fried rice, meatballs, dust, soil, vegetables	Vomiting, abdominal pains 1-6 h after eating Diarrhoea 8-16h after eating contaminated food	Don't store food at room temperature. Keep yourself and kitchen clean.
C perfringens	Inadequately cooked meat, poultry, or legumes. Animal and human waste. Soil, vegetables, insects.	Acute onset of abdominal cramps with diarrhea starts 8-24 h after ingestion.	Separate raw and cooked food. Keep premises clean. Wash vegetables and hands. Cool food quickly.
C botulinum	Canned foods (eg, smoked fish, mushrooms, vegetables, honey)	Descending weakness and paralysis start 1-4 d after ingestion, followed by constipation. Mortality is high	Wash vegetables. Thoroughly cook food. Don't use food from damaged cans or jars or home canned products.

Food poisoning

Bacteria	Source	Symptoms & onset time	Precautions
Enterotoxic *E coli* (eg, traveler's diarrhea)	Contaminated water and food (eg, salad, cheese, meat)	Acute-onset watery diarrhea starts 1-2 d after ingestion +/- Vomiting and abdominal cramps Lasts for 1-2 d	Use clean water. Separate raw and cooked food.
Salmonella	Beef, poultry, eggs, and dairy products	Abrupt onset of diarrhea and fever; in some cases, bloody diarrhea, +/- abdominal pain and vomiting, beginning 6-48 h after exposure, lasts 7-12 d	Don't wash chickens. Separate raw and cooked food.

Foodborne diseases

Bacteria	Source	Symptoms & onset time	Precautions
Enterohemorrhagic *E coli* O157	Improperly cooked hamburger meat and previously spinach	Starts 3-4 d after ingestion Can lead to serious kidney damage.	Thoroughly cook food. Keep raw and cooked separate. Double wash fruit and vegetables.
Campylobacter	Domestic animals, cattle, chickens. Untreated milk.	Abdominal pain and fever starts 1-3 d after exposure and recovery is in 5-8 d. Foul-smelling watery diarrhea followed by bloody diarrhea.	Thoroughly cook food. Keep raw and cooked separate. Double wash fruit and vegetables. Only use pasteurized milk.
Shigella	Potato, egg salad, lettuce, vegetables, milk, ice cream, and water	Abrupt onset of bloody diarrhea, cramps, tenesmus, and fever starts 12-30 h after ingestion. Lasts 3-7 d	Separate raw and cooked food.
Hepatitis A	Contaminated water, raw and undercooked shellfish. Untreated milk.	15-50 DAYS after ingestion. Nausea and vomiting, tiredness, abdominal pains, fever, jaundice.	Thoroughly cook food, wash hands, keep raw and cooked food separate.

Foodborne diseases

Bacteria	Source	Symptoms & onset time	Precautions
Listeria	Unpasteurized soft cheeses (Brie, Camembert). Meat pate	1-70 days after ingestion. Mild flu like illness. Septicaemia and meningitis in young, elderly and immunocompromised. Miscarriage/ stillbirth.	Avoid eating high risk foods. Clean refrigerator regularly. Listeria can multiply at refrigerator temperatures.
Norovirus	Infected food handler. Contaminated water or objects, airborne.	VOMITING, +/- diarrhoea, fever, abdominal pains 1-2 days after ingestion.	Wash hands, Thoroughly clean toilet areas. HIGHLY INFECTIOUS

Prevention of foodborne illnesses

- Education
- Prevent contamination: Hygienic premises, quality food selection, delivery, storage, personal hygiene
- Prevent microbes from growing and producing toxins: Time and temperature controls
- Prevent cross contamination

Causal factors relating to outbreaks of food poisoning
(In England and Wales 1970-1982)

	Causal factor	% of outbreaks
1	Preparation too far in advance	57
2	Storage at ambient temperature	38
3	Inadequate cooling	30
4	Inadequate reheating	26
5	Contaminated processed food	17
6	Undercooking	15
7	Contaminated canned food	7
8	Inadequate thawing	6
9	Cross contamination	6
10	Raw food consumed	6
11	Improper warm holding	5
12	Infected food handlers	4
13	Use of leftovers	4
14	Extra large quantities prepared	3

Physical contamination

This can occur in a variety of ways at different stages of food processing and production. Some examples are:

- soil from the ground when harvesting;
- a bolt from a processing plant when packaging;
- a hair from a cook in the kitchen.

Care must be taken at each stage to prevent physical contamination.

Chemical contamination

This can occur in a variety of ways at different stages of food processing and production. Some examples are:

- chemicals from the farm;
- a cleaning product used in the processing plant when packaging;
- fly spray used in the kitchen when preparing food.

Care must be taken at each stage of food production to prevent chemical contamination.

Desirable food changes

Autolysis and micro bacterial changes are sometimes desirable (and are not referred to as spoilage), for example enzymes cause fruit to ripen.

Here are some positive micro bacterial changes below.

Bacteria in yoghurt production.

Mould in some cheeses, e.g. Stilton.

Yeast in bread production.

Autolysis – enzymes

Enzymes are chemicals that are found in food.

These chemicals have important uses in food. They can cause food to deteriorate in three main ways:

- ripening – this will continue until the food becomes inedible, e.g. banana ripening;
- browning – enzymes can react with air causing the skin of certain foods, e.g. potatoes and apples discolouring;
- oxidation – loss of certain nutrients, such as vitamins A, C and thiamin from food, e.g. over boiling of green vegetables.

Enzymatic Action

- Enzymes are substances found naturally in animals and plants. Enzymes of humans help break down food into simpler forms.
- Enzymes of bacteria in raw food help liquefy the food to produce a slimy coating that causes food to spoil faster.
- However, enzymatic action only affects the appearance of the food.

4. Food Hygiene:
4.1. Good hygiene and manufacturing practice

- Cross contamination
- Temperature management (Cooking, reheating, cooling, thawing)
- Cleaning and disinfection
- Controlling food pests
- Store food correctly

Cross-contamination

Cross-contamination usually involves a vehicle of contamination something that helps the bacteria to 'travel' from one surface to another.

E.g. Raw to cooked food

Vehicle can be:

- Food handler
- Food contact surface
- Equipment and utensil

Cross contamination

- The way bacteria and viruses are moved from one area to another – from a dirty area to a clean one.
- Common sources:
  - Storing raw and ready to eat foods together
  - Leaving food uncovered
  - Using the same utensils for raw and ready to eat foods
  - Handling raw and then ready to eat foods without washing hands or equipment.

Ways to avoid cross contamination

- Meticulous personal hygiene
- Workflow and practices properly planned
- Use utensils rather than hands to touch food
- Raw and cooked foods kept separate during transport, storage and preparation
- Store raw foods below cooked foods in refrigerator
- Food should be handled as little as possible
- Food handlers shouldn't work if sick
- Clean surfaces appropriately
- Separate chopping boards for raw and ready to eat
- Safe rubbish disposal

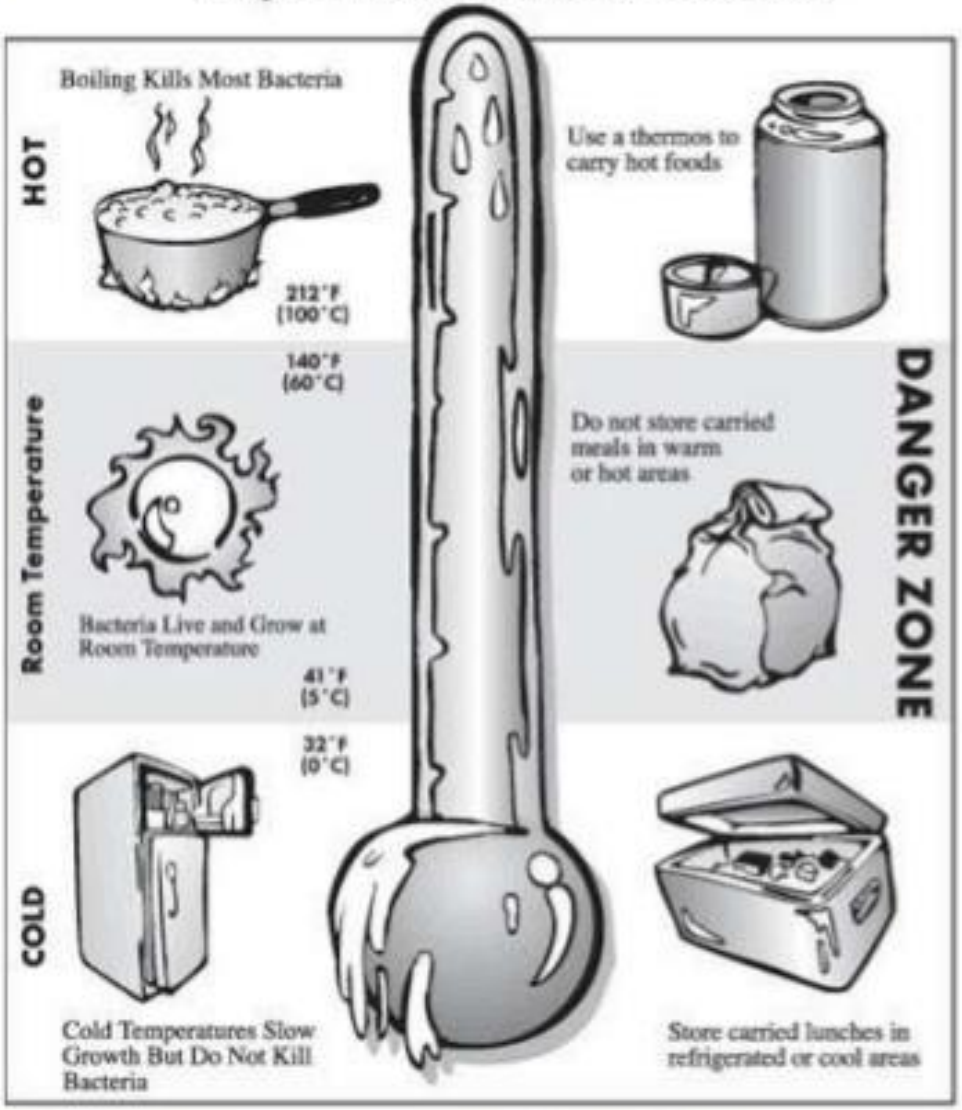
Temperature Management

Cooking and reheating

- Cooking food to a minimum core temperature of 75 degrees will ensure most bacteria are destroyed.
- Liquids should be stirred frequently with a clean utensil
- Food should never be reheated more than once and any uneaten reheated food thrown away.
- Cutting food into smaller portions will make cooking easier and core temperatures will be achieved sooner.

Picture: https://www.halton.ca/cms/one.aspx?portalId=8310&pageId=37841

Keep Hot Foods Hot & Cold Foods Cold



Recommended Safe Minimum Internal Temperatures

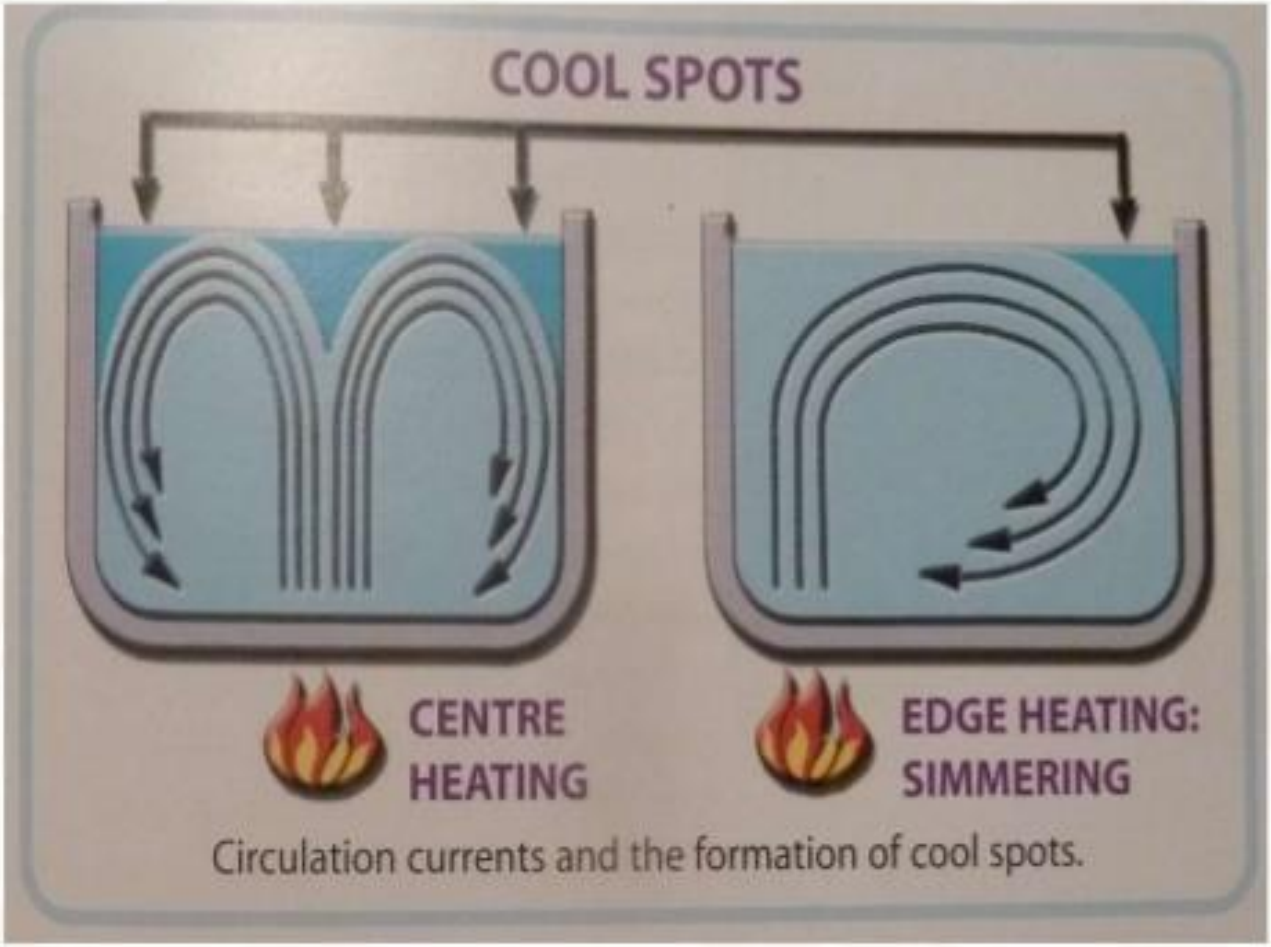
Steaks, roasts 145 °F	Fish 145 °F	Pork 160 °F	Ground beef 160 °F	Egg dishes 160 °F	Chicken breasts 165 °F	Whole poultry 165 °F
63 °C		71 °C			74 °C	

Picture: http://www.emedicinehealth.com/food_safety_cooking-health/article_em.htm

Temperature Management – Cooking and simmering bulk liquids:

- Temperature distribution within bulk liquids during cooking is not uniform. Stable convection currents are set up and liquid outside these currents may remain stationary at a low temperature. While some areas of a liquid may be visibly boiling, other areas may be at a temperature that allows the multiplication of *Cl. perfringens* (one of the most common causes of food poisoning).
- Especially when a pan has no lid, and the pan contents are unstirred, clostridia within the cool spots can survive and multiply under virtually ideal conditions.
- **Pans should be stirred at least every 10 minutes using a clean utensil.**
- Excessive cold air draughts should be kept away from cooking areas, and lids kept on pans between stirring.

Temperature Management – Cool spots



Circulation currents and the formation of cool spots.

Temperature management
Defrosting

- Defrost food thoroughly before cooking or reheating.
- Defrost frozen food either in a microwave, or in the fridge. If using the fridge, defrost food on the bottom shelf, away from other foods just in case it drips as it is defrosting. You can keep fully defrosted food in the fridge for a short time until it is ready to be cooked or reheated.
- Cook or reheat the food immediately if defrosted in the microwave.

Temperature management
Defrosting

- You should always:
- defrost food in a refrigerator or microwave (on the defrost setting)
- allow plenty of time to defrost thoroughly, especially for large objects that take longer to defrost all of the way to the centre, such as large chickens or other pieces of meat
- reheat cooked food to 75ºC or hotter
- check the temperature of the food with a washed and sanitised probe **thermometer** after cooking or reheating.

Temperature Management: Cooling food

- Food that has just been cooked or taken out of the oven to cool should not be left out more than **2 hours**.
- Hot food should not be put directly into the fridge. If you put food in the fridge when it is still hot it may cause the internal fridge temperature to rise, putting all food stored in the fridge at risk of being in the temperature danger zone.
- Once the food is in a suitable storage container, cool the food on the bench to about 21°C.

Temperature Management: Cooling food

- use a washed and sanitised thermometer to check temperature
- cool food in clean, shallow and uncontaminated storage containers
- cover and mark containers with the food type, the time and the date, before putting them in the cool room, fridge or freezer
- check that the temperature inside the fridge is below 5°C while cooling food.

Temperature Management: Cooling food

- Don’t overpack the fridge as this stops cool air circulating freely and the fridge will not keep the foods properly chilled.

The right conditions

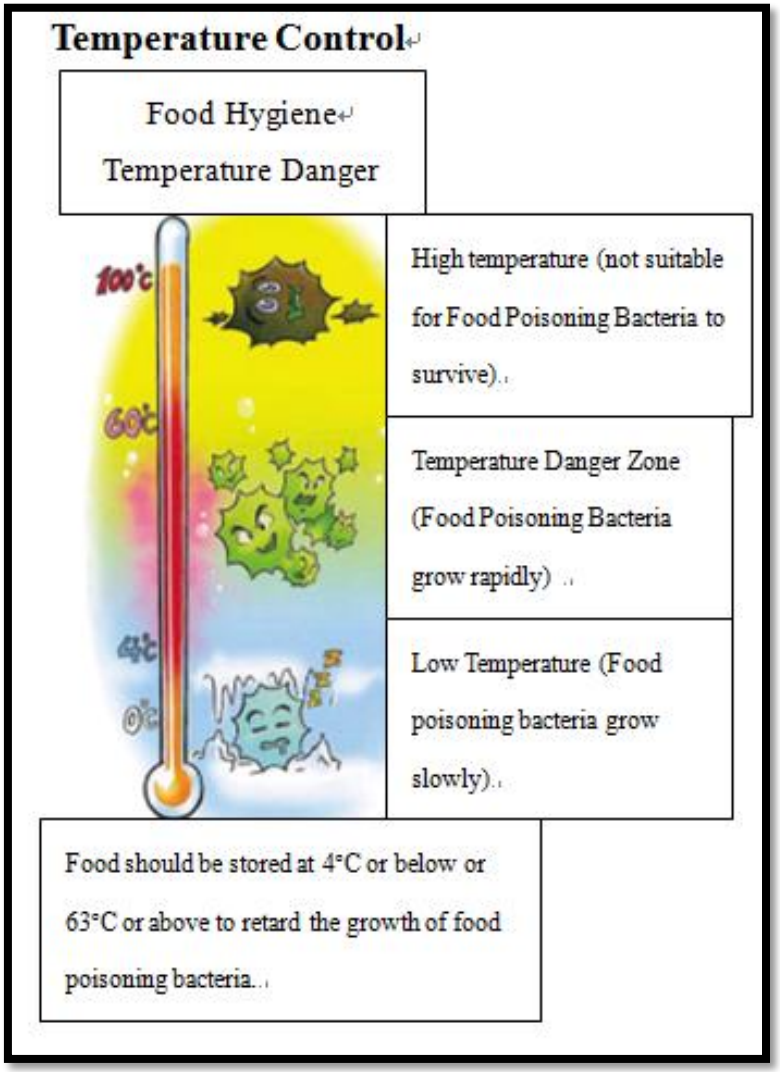
For bacteria to multiply they need:

- Time
  - Under optimum conditions bacteria can double every 10 to 20 minutes. For example, if food contains 1,000 bacteria in the beginning, their number can reach 1,000,000 within 1 hour and 40 minutes. Such amount of bacteria per gram of food can cause illness.

- Warmth
  - In the danger zone i.e. 4℃ to 63℃ bacterial multiplication occurs fastest and needs controlling.

- Moisture
  - Critical for multiplication and this is the reason why it is vital to dry surfaces, where possible, after washing up to deny bacteria moisture. This is also one of the reasons why the sink and surround in a kitchen often has the highest level of bacteria.

- Food
  - The available food for bacteria to utilise, survive and multiply. Food rich in moisture and protein such as milk and meat, are very suitable for the growth of bacteria. They are also called “high risk food”.



- **Most suitable temperature for bacteria growth**
- It is called optimum temperature: between 20 to 45 °C

- **Temperature danger zone**
- 4 to 60°C
- Food should not be placed at temperature danger zone for over 2 hours

- **Influence of high temperature on bacteria**
- Above 60°C: most of the bacteria would stop growing
- Over 60 °C : bacteria start to die off, and the higher the temperature, the less time it takes to kill bacteria
- Bacteria can produce spores, which can survive at high temperature
- Cook food thoroughly by maintaining the core temperature at 75 °C for at least 15 seconds

Chilled Storage– principles of safe storage

- Clean chiller regularly to avoid dirt and ensure efficiency
- The temperature of the refrigerator should be
- kept between 1 ℃ to 4 ℃
- Cover and label food
- Keep food tidy and orderly
- Don’t overstock

Chilled Storage– principles of safe storage

- No warm food
- Separate raw and ready-to-eat foods
- If raw and ready-to-eat are to be stored in the same unit,
- Ensure raw is on shelves below ready-to-eat food
- Preferably, use separate units
- Open cans should not be stored in refrigerator

Bad Practices

Bad Practices

Storage food properly ?

Storage food properly

Frozen Storage – principles of safe storage

- **At -18℃**
- **Clean freezer and defrost regularly**
- **Defrost thoroughly**
- **Cover and label food**
- **Keep food tidy and orderly**
- **Don’t overstock**
- **No warm food**

Safe methods for defrosting foods

- You can defrost foods in a:
  - Chiller < 5℃
  - Microwave (following manufacture's instructions)
  - Well cover with an appropriate container and place within the chiller
  - Use specialist defrosting unit
  - Do not re-freeze thawed food
  - Check before cooking to ensure that the product is completely defrosted
  - Food must not be thawed out at room temperature
  - Unless thawed food is processed immediately, it should be held at 8℃ or below until being used
  - Food thawed in microwave ovens should be cooked immediately.

Safe cooking temperatures

- Food must be cooked thoroughly, especially meat and poultry. Adequate cooking time is needed to allow food to attain the temperature capable of killing bacteria and completely cooked

- Raw animal food (e.g. poultry, pork, minced meat), the centre of the food should reach a temperature of at least 75 ℃ for 15 seconds, or an effective time / temperature combination (e.g. 65 ℃ for 10 minutes, 70 ℃ for 2 minutes)

- Food which do not require heating before consumption should not be put under room temperature, and should be stored under refrigeration immediately after processing

Safe cooking temperatures

- It is important that foods are cooked thoroughly and the target temperature is achieved throughout. Undercooking will enable bacteria to survive

- Microwave cooking
  - Rotated or stirred food throughout or midway during cooking
  - Heated to a temperature of at least 75 ℃ for 15 seconds in all parts of the food
  - Allowed to stand covered for a minimum of 2 minutes after cooking to obtain temperature equilibrium

Cooling & Reheating

- **Cooling**
- Food that has been cooked, and is intended to be kept under refrigerated storage prior to serving should:
  - Be cooled from 60 ℃ to 20 ℃ within 2 hours or less; and
  - From 20 ℃ to 4 ℃ within 4 hours or less
  - Containers should not be stacked up during cooling and there should be a free space in between containers to allow cold air inside the refrigerator / cooling cabinet free circulation

- **Reheating**
- Food that has been cooked and cooled, when reheated, should be reheated to 75^{o}C or above as quickly as possible. Normally, the reheating time should not exceed 2 hours.
- Food that has been reheated should not be cooled and reheated for a second time.

Serving

- Keep food above 60 ℃ or below 4 ℃ (be more safety, is can be up to 63 ℃)
- Minimize bare-hand contact with ready-to-eat food
- If gloves are used to handle ready-to-eat food, they should be of single-use
- Ice to be used in food and drink should not be handled with bare hands
- Refresh food displays with completely fresh batches of food. Avoid mixing old food with fresh batches
- Do not wipe utensils with aprons, soiled cloths, unclean towels, or hands
- Never re-use single-use items, such as straws, paper towels, disposable cups and plates
- Once served to a consumer, portions of leftover food should not be served again

Food Displaying

- Display food should be stored inside cold (at 4 ℃ or below), or hot (at 60 ℃ or above) cabinet, unless it is intended for short time display
- Ensure the food intended to be displayed frozen remain frozen (preferably at –18 ℃ or below)
- Ensure the package of pre-packaged food intact and unbroken
- Cover unpackaged ready-to-eat food with lids or protect it with food guards/sneeze guard.

Hot holding

- Hot holding, by law, must be at or above 63℃.
- Food will have been cooked or re-heated to higher temperature and if held at 63℃ or above food will be out of the danger zone.
- If the temperature of the food drops below 63℃, it must be sold within two hours or destroyed because of the potential for bacterial survival and multiplication.

World Health Organization (WHO)

5-Keys to Food Safety

Advocated by the World Health Organization to prevent foodborne diseases (3C+2S)

1. Choose (Choose safe raw materials)
2. Clean (Keep hands and utensils clean)
3. Cook (Cook thoroughly)
4. Separate (Separate raw and cooked food)
5. Safe Temperature (Keep food at safe temperature)

Date marking

- All pre-packed foods come with a date indication on the label. These are either ‘use-by’ or ‘best-before’ dates.

Use-by date on ready-to-eat foods –illegal to sell food past its use-by date

Best-before date – canned, dried and frozen products – can be sold past best-before date, but safety and quality could be compromised

Personal hygiene

- Human body is the source of many types of contamination and also a common medium of cross contamination. Food handlers must always keep up with a high personal hygiene standard to ensure food safety.

- Good appearance
  - Hair should be short and covered with hat
  - Heavy make-up, strong perfume or aftershave should be avoided
  - Open wound should be covered by bandage
  - Clean and tidy uniform and shoe

Personal hygiene

- In food preparation areas, one should avoid the following behaviours which may result in contamination of food:
  - Storing personal belongings, such as handbags, shoes and dirty clothing, in any food preparation area
  - Smoking cigarettes or tobacco
  - Spitting
  - Chewing, eating, sneezing or coughing over unprotected food or food contact surfaces
  - Sitting, lying or standing on any surfaces of equipment touched by food
  - Touching ready-to-eat food with bare hands or tasting food with fingers
  - Combing/touching hair or other parts of the body such as nose, eyes

* **Staff engaged in food handling should not be assigned to handle cash simultaneously.**

Personal hygiene issues….

- Before commencing work, work uniform and aprons (or clothings) must be clean and fit for the purpose
- Wear mouth masks when handling food as far as possible
- Do not wear work uniform outside food handling area
- Daily clean uniform or even change twice
- Should shower daily – for and after service
- Tell the manager before work if they have suffered from diarrheas, vomiting or skin problems
- Shampoo your hair as often as necessary to keep it healthy and clean
- Keep your fingernails clean, well-trimmed, and free of nail polish

Personal hygiene

- The purpose of protective clothing: to protect the food from the handler

- What properties should protective clothing have?
  - Light (so dirt can be seen),
  - washable,
  - no pockets,
  - no buttons or potential physical contaminants,
  - disposable, etc

- Reasons for wearing:

a. Hat/hair net
   - stops hands touching hair and ears (sources of Staphylococcus aureus) and stops hair falling into the food (contamination)

b. Beard snood
   - stops facial hair falling into the food

c. Apron/ Chef jacket/Trousers
   - protect the food from contamination that might be on the food handler's clothes

d. Dedicated shoes
   - to stop any contamination from the soles of outdoor shoes. Also for health and safety reasons – e.g. to prevent slips

e. Gloves
   - sometimes used to handle ready-to-eat food to act as a skin barrier, but if hands are kept clean, there should be no need to wear gloves

Personal Hygiene (Keep hands clean)

- **Experimental results on hand washing:**
  - When hand basin is used for hand washing, about 26% of the bacteria will remain
  - With running water, about 20% of the bacteria will remain
  - When soap is being used, almost all bacteria will be removed

Hand washing

One of the most important actions you can take to help prevent contamination.

But why is hand washing so important?

Hand washing

1. It is normal for a population of harmful micro-organisms to be carried on our hands at any time.

2. However activities in our every day life such as handling raw meat or visiting the toilet can significantly increase the presence of more harmful ones.

3. It is vital in preventing contamination of food by food handlers. Harmful bacteria such as E. coli, Salmonella and Staphylococcus aureus and viruses (e.g. norovirus) present on the hands of food workers.

4. These micro-organisms are so small that you are unable to see them with the naked eye.

5. It is not only important to wash your hands, but also to do so properly.

6. Bacterial can be removed by proper hand washing techniques.

Washing facilities

Hand wash facilities with hot and cold water, soap and drying facilities

Separate food and equipment sinks with hot and cold water

When should you wash you hand?

- Before:
  - staring food preparation
  - before wearing plastic gloves
  - handling high-risk food

- After:
  - taking a break
  - sneezing
  - wearing plastic gloves
  - blowing the nose
  - preparing ready to eat food and raw materials
  - touching contaminated articles (solid dishes, packaging, garbage)
  - toilet
  - eating or drinking
  - touching the face or hair

Six Steps for Hand Washing

1. Wet hands and exposed portion of forearms with warm water.

2. Using soap, work up a lather that covers hands and forearms.

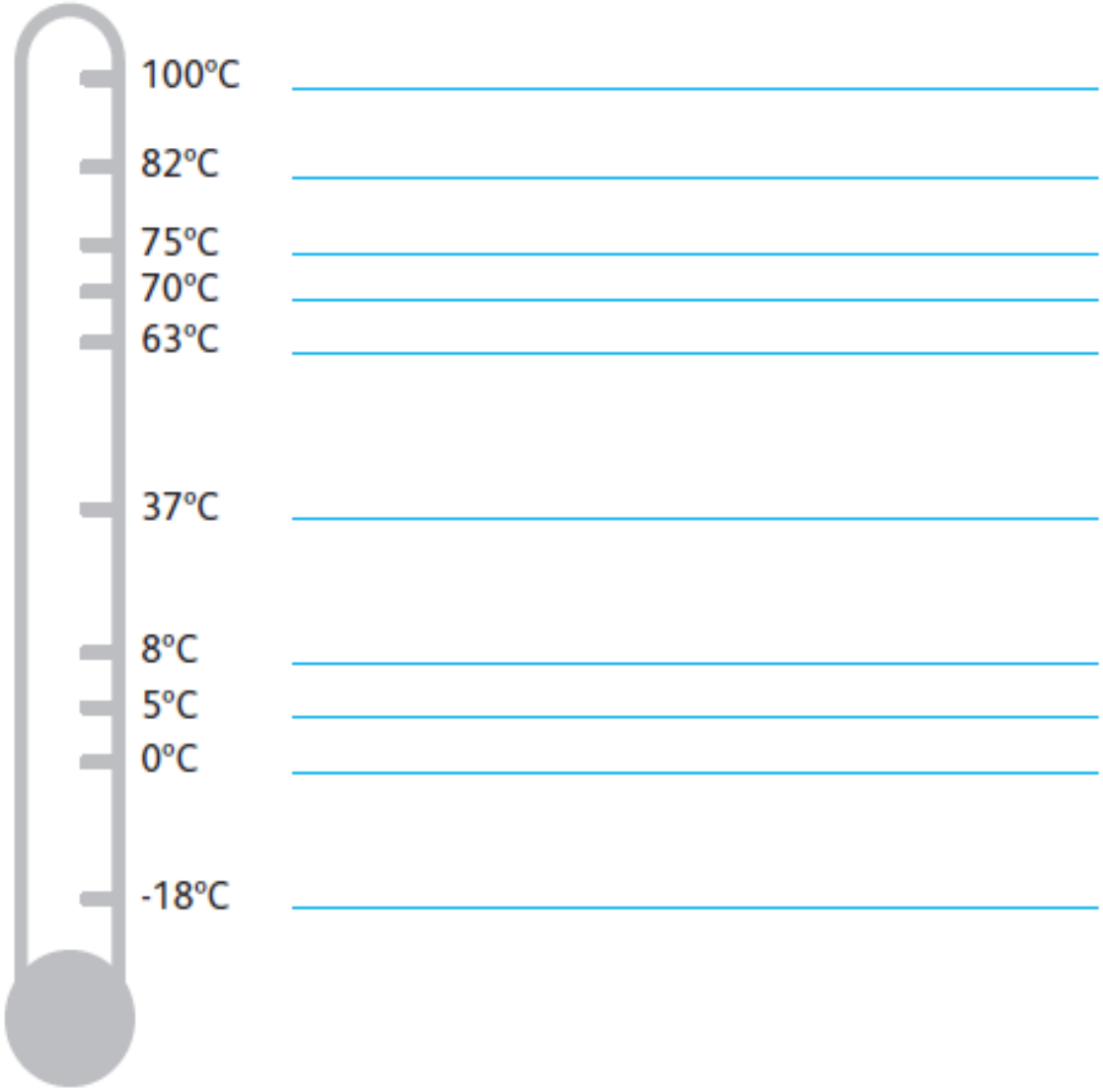
3. Vigorously rub hands together for at least 20 seconds. Pay particular attention to the areas under the fingernails and between the fingers.

4. Rinse hands and forearms in clean water.

5. Dry hands and forearms.

6. Turn taps off with paper towel if available.

Temperature indicate



- Cook

- Boiling point
- Bacteria stay
- Reheat
- Upper limit to danger zone
- Body temperature
- Lower limit of danger zone
- Disinfect
- Refrigerator or chilled product maximum temperature (for fresh vegetable)